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at

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Ithaca, N. Y.

September 8-9-10, 1952

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INHIBITION OF POTATO SPROUTING BY 2, 3, 5, 6-TETRACHLORONITROBENZENE AND METHYL ESTER OF A-NAPHTHALENEACETIC ACID[1]

J. HOWARD ELLISON[2]

In a report from England, Brown (1) stated that tetrachloronitrobenzene (TCNB) was quite inhibitory to sprout growth of potatoes. Numerous workers in America have reported sprout inhibition of potatoes by methyl ester of a-naphthaleneacetic acid (MENA) (2,3,4,5,6,7,8). A sample of 2,3,5,6-tetrachloronitrobenzene was obtained in 1949 in order to compare it with MENA.

METHODS

Paper Bag Test. An exploratory test was set up on February 1, 1949, to compare TCNB with MENA as a sprout inhibitor on four varieties of potatoes. Tubers of Harford, Virgil, Sebago and Snowdrift, which had begun to sprout in storage, were desprouted and separated into lots of twelve. Each lot was treated and stored separately in a brown paper bag. TCNB was used at the rate of 3.64 grams of active ingredient per bushel and MENA was used at the rate of 1 gram per bushel. Both chemicals were applied in dust carriers, and untreated tubers of each variety were left as controls. The varieties and sprout inhibitors were combined in factorial arrangement in three replications. The bags were stored in an office cellar, in which the temperature averaged approximately 60 degrees F and the relative humidity averaged about 40 per cent. On April 30, 1949, the tubers were desprouted and the sprouts weighed to the nearest gram.

Large Bin Experiment. This experiment was set up in a common storage on October 26, 1949, using the variety Green Mountain. The treatments consisted of TCNB at 2.7 grams per bushel, MENA at 1 gram per bushel, methyl ester of 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) at 1 gram per bushel and an untreated control. Treatments were applied to potatoes in bins of 25 bushel capacity, and four replications were used. The entire experiment consisted of 400 bushels of potatoes stored in 16 bins, which simulated actual commercial storage conditions. The temperature varied from 45 to 50 degrees F in the fall to 35 to 40 degrees F in midwinter. The relative humidity was 90 per cent or above for the entire experimental period. Sprout inhibitors were applied in dust form to potatoes as they were placed in the bins. The experiment was broken down on January 12 and 13, 1950, at which time two 50-tuber samples were taken near the center of each bin for sprout growth measurements.

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Paper No. 344 of the Department of Vegetable Crops, Cornell University, Ithaca, N. Y.

[2]Assistant Professor of Vegetable Crops, Cornell University, Long Island Vegetable Research Farm, Riverhead, N. Y.

The author is indebted to the Sterling-Winthrop Research Institute, Rensselaer, N. Y., for contributing a Research Grant in support of this study, and for supplying the TCNB (Fusarex). Appreciation is expressed also to the Dow Chemical Company, Midland, Michigan, and to the American Cyanamid Company, 30 Rockefeller Plaza, New York, N. Y., for contributing the MENA (Dow Sprout Inhibitor and Barsprout, respectively) used in this study.

Bag versus Bin Test. Dormant Green Mountain tubers, which had been in common storage for four to six weeks, were used in a test to study the sprouting behavior of small lots in paper bags compared to larger lots in bins. On December 6, 1950, ten lots of ten tubers each were placed in paper bags and treated with TCNB at the rate of 2.7 grams per bushel. Ten similar lots were used as untreated controls. Two bins of ten-bushel capacity each were set up in the same manner as the bags in that one contained tubers treated with TCNB at 2.7 grams per bushel and the other bin was untreated. The bags and bins were stored side by side in an office cellar with the temperature around 60 degrees and the relative humidity approximately 40 per cent. On January 29, 1951, five samples of ten tubers each were removed from the central portions of the bins and desprouted, the sprouts being weighed to the nearest gram. The tubers stored in bags were desprouted and the sprouts similarly weighed.

Results and Discussion

Paper Bag Test. When used on small lots of tubers in paper bags, MENA retarded sprouting much better than did TCNB (Table 1). TCNB reduced sprouting compared with the control, but the reduction was not of practical significance. The varieties Harford, Virgil, Sebago and Snowdrift responded in essentially the same way to MENA and TCNB.

Table 1.—*Mean weight of sprouts from lots of 12 tubers stored in paper bags. (Stored February 1 to April 30, 1949)*

	Grams
MENA (1 gm./bu.)	10
TCNB (3.6 gm./bu.)	77
Control	91
L.S.D. .05	13

Large Bin Experiment. TCNB inhibited sprouting significantly better than MENA when used on potatoes in bins of 25-bushel capacity, although there was no practical difference in the amount of sprouting (Table 2). Both materials kept the tubers in good condition. Although 2,4,5-T reduced sprouting significantly compared to the control, this was not a practical treatment, because the tubers still sprouted enough to cause serious economic loss. Figure 1 is a photograph of one replication of the bin experiment, showing the differences in sprouting. Figure 2 shows the sprouts removed from 400 tubers from each of the treatments in the bin experiment.

Bag versus Bin Test. To check on the discrepancy in the performance of TCNB in bags and in bins, a test was conducted in which TCNB was used on tubers in small bags and in a bin of 10-bushel capacity. All lots were stored under the same conditions. In bags the TCNB reduced sprout growth slightly, but in the bins, sprouting was nearly eliminated by the TCNB (Table 3).

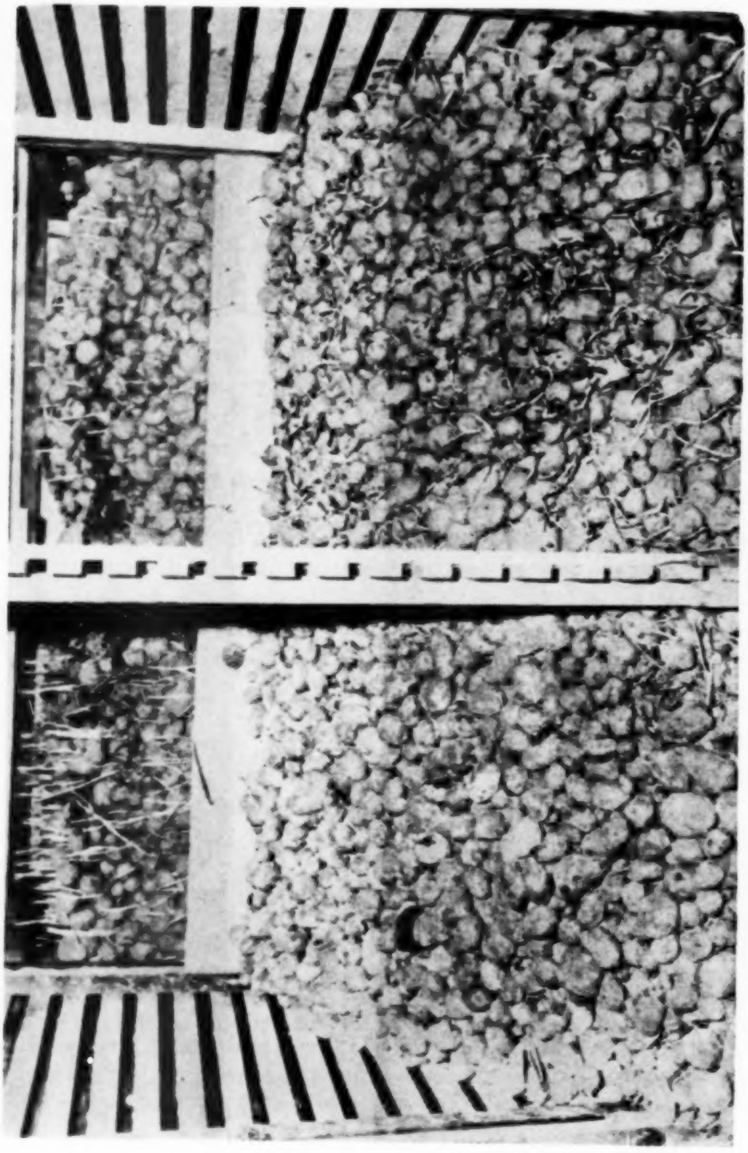

Fig. 1.—Upper left: untreated control, upper right: MENA, lower left: TCNB, lower right: 2, 4, 5-T. Treated October 26, 1949 and photographed January 13, 1950.

TABLE 2.—*Mean weight of sprouts per 100 tubers from bins of 25 bushel capacity. Stored October 26, 1949 to January 12-13, 1950.*

	Grams
TCNB (2.7 gm./bu.)	16
MENA (1 gm./bu.)	48
2,4,5-T (1 gm./bu.)	168
Control	248
L.S.D. .05	32

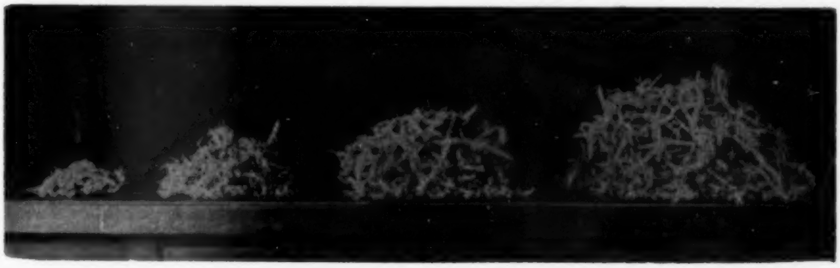

Fig. 2.—Each pile of sprouts is from 400 tubers. Treatments (left to right) TCNB, MENA, 2, 4, 5-T and untreated control.

TABLE 3.—*Weight of sprouts per ten tubers from small and large lots of potatoes. Stored December 6, 1950 to January 29, 1951.*

	Ten Tubers per Lot	Ten Bushels per Bin
	Grams	Grams
TCNB	33	0.25
Control	44	38.40

Figure 3 shows the difference in sprout growth between treated and untreated tubers in the bins. A six-inch layer of potatoes was removed from each bin, with a few top layer tubers left in one corner of each bin. Note how tubers in the top layer of the treated bin sprouted. Likewise, tubers around the outside edge of the treated bin sprouted considerably, although the potatoes three inches inside the bin sprouted scarcely at all. This shows that TCNB does not inhibit sprouting when the treated tubers are exposed to the outside air. Small lots of potatoes treated with TCNB sprout for the same reason, namely, because the mass is so small that essentially all the tubers are exposed to the air. In large bins, a very small proportion of the tubers are exposed to the air, so that relatively few potatoes would sprout in a TCNB-treated bin.

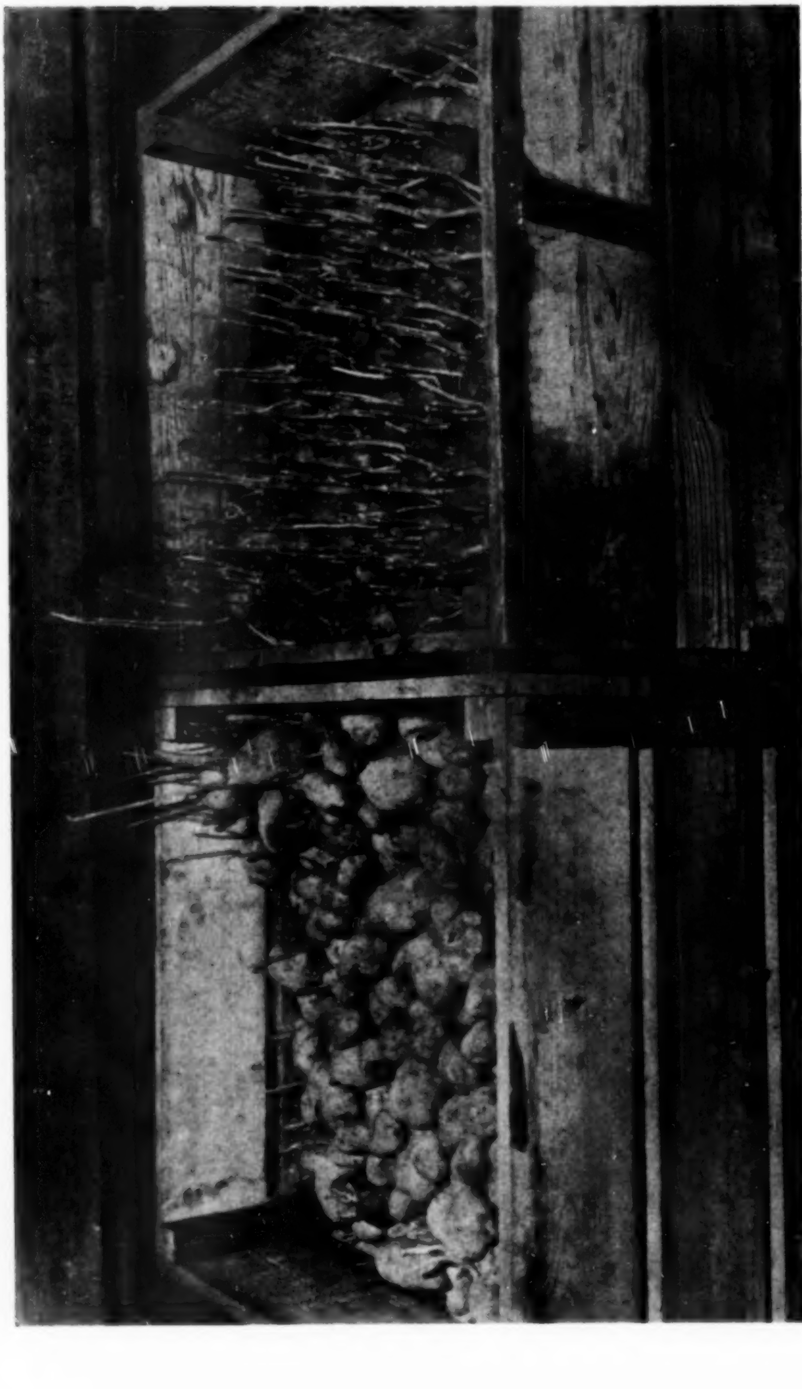

Fig. 3.—Left: Potatoes treated with TCNB, Right: untreated control. Treated December 6, 1950 and photographed January 29, 1951.

Summary

Three separate though related tests are reported in this paper. It was found that 2,3,5,6-tetrachloronitrobenzene (TCNB) was an excellent inhibitor to sprouting when used in bins of 10 or 25-bushel capacity, although it was a poor sprout inhibitor when used on lots of 10 or 12 potato tubers. TCNB was ineffective when treated tubers were exposed to free air circulation, as demonstrated by the excessive sprouting of tubers at the surface of treated bins. Methyl ester of a-napthaleneacetic acid (MENA) proved to be a good sprout inhibitor when used in either small or large lots of potatoes. Poor sprout inhibition resulted from the use of methyl ester of 2,4,5-trichlorophenoxyacetic acid (2,4,5-T).

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FACTS ABOUT POTATO QUALITY [1, 2]

L. W. Pearsall[3]

With potatoes, as with all agricultural products, all problems come in one of two main fields, production or marketing. The two, of course, must work hand in hand, because what is produced has to be marketed, and what the market wants should be produced.

In the Marketing Service of the Department, our primary interest is obviously in marketing and our chief association with the marketing field is in grading.

Recently, we have been examining rather seriously our position with respect to potato grading and I was very glad to accept Mr. Goodin's invitation to discuss the details with you.

At the present time, with the 1951 potato crop 30 per cent below the previous year, and with prices at least double those of a year ago, a discussion on marketing problems might be considered somewhat academic. However, to avoid getting caught like Paddy, who couldn't shingle his roof when it was raining and didn't think it needed it when it wasn't, it might be worthwhile to give some thought to a bit of shingling in anticipation of what could and probably will happen next year. The same acreage used for potatoes in 1952 as in 1951 could, with better growing conditions, produce an embarrassing surplus.

The principle of grading farm products is relatively simple. The first step is to set up grade standards which truly reflect difference in quality. Those standards can then be utilized for a variety of purposes. They can be used as a basis of graduated payments to producers in order to encourage the production of better quality. They can be used as a basis of sale to consumers so that the housewife can buy foods with the assurance that the quality will be what she wants. And in between those two they can be utilized as a basis of trading between commercial interests.

The utility of grading as an effective force in building consumer confidence and, from that, a sound market position has been well demonstrated in several products. To use two illustrations, the eggs or butter which consumers can buy in retail stores today, with quality identified by the grade mark, are quite different from the miscellaneous type of product which was sold earlier in this century. And there is no doubt in the minds of those in the dairy or poultry industries that their basic market position has been infinitely improved as a result.

The setting up of grade standards and the administration of regulations concerning the application of the grades obviously can best be handled by a Government agency. In the Marketing Service we have to do with the grading of a wide variety of agricultural products, including potatoes.

Potato grades and potato grading have, of course, been in existence for a long time. In fact, they started in 1922, but in recent years we have been getting an increasing reaction from users that when they bought potatoes by grade they weren't getting what they expected and particularly that they weren't getting the cooking quality they wanted. Some may be disposed to challenge that, but all the evidence indicates that

[1]Accepted for publication February 23, 1952.

[2]Given at Ontario Crop Improvement Association Convention, Toronto, January 22nd to 25th, 1952.

[3]Director, Marketing Service, Department of Agriculture, Ottawa, Canada.

there has been a deterioration in quality and that there is no criterion by which the consumer can be sure of purchasing uniform quality good cooking potatoes and of getting the same quality week in and week out throughout the year.

That raises two implications. With potatoes, the chief emphasis in our grading work has been on shipping point inspection — using the grades as a basis of trading between commercial interests. The Government has provided considerable staffs and financial appropriations for that purpose. That can be justified if the results are commensurate with the expenditures. But if the complaints were justified — if grading was not giving consumers the kind of potatoes they wanted — then it was obvious that administratively we would have to take a serious look at our grading operations.

The second implication is that if you in the potato industry are going to build a sound market position you must win and retain the confidence of your customers who, in the main, are the Canadian housewives and commercial users of potatoes.

We felt that we had the responsibility of taking a serious look at the matter. We have made a number of investigations and the purpose of this report is to bring you up to date on them.

The work which we have been doing on this has taken two forms.

First, we have been checking to see whether the grade name marked on consumer packages of potatoes in retail stores truly indicated the grade of potatoes in those packages. For if grading is to mean anything to the consumer — and that surely is a primary purpose of grading — she should at least be sure that when she buys potatoes marked with a certain grade they are, in fact, properly graded.

The *second* approach has been to try to find out whether the factors which have been used to determine the grade of potatoes are really the factors in which the consumer is vitally interested, and if not what additional considerations should be added in grading.

Early last year, from January to May, we picked up 600 consumer packages of potatoes in retail stores in Toronto, Montreal and Ottawa. Practically all of them were marked "Canada No. 1" grade. They came originally from New Brunswick, Prince Edward Island, Ontario and Quebec. Each package was checked to see whether it was up to grade by the present standards and tolerances. Here are the results.

Of the Prince Edward Island potatoes, 55 per cent of the packages were below grade; New Brunswick 59 per cent; Ontario 85, and Quebec 86 per cent.

A further check was made in November in Toronto when 300 samples were picked up, one-half from the Maritimes and one-half from Ontario. In that test 61 per cent of the Maritime samples were below grade and in the Ontario samples 92 per cent were below.

Now, the above-mentioned figures do not mean that so many individual potatoes were below grade. But in the individual packages there were sufficient potatoes below grade to cause the entire package to be improperly graded to the extent indicated.

In our last test the results were broken down to a basis of individual potatoes. In those originating in the Maritimes eleven per cent of the individual potatoes were below grade, whereas in the Ontario potatoes twenty per cent were below.

The nature of these individual undergrades is interesting. In the Ontario potatoes fourteen per cent were below grade for causes other than bruising, compared with only four per cent in the Maritime samples. But in both the Ontario and Maritime samples six per cent were below grade for bruising. However, apart from the details, these checks did seem to indicate that consumers are not getting potatoes graded as accurately as they have a right to expect.

Why is that so? One explanation that occurred to us is that our own potato inspection work, as I mentioned earlier, has been concerned primarily with shipping point inspection. Checking on the grade of potatoes at retail stores has not been done as actively as with some other products, such as butter and eggs. So we asked ourselves whether, with more concerted retail checking, it would be possible to improve the situation.

That was tried in Winnipeg, where arrangements were made for the regular staffs of some other divisions which were engaged steadily on retail work to carry on an active check on the grading of potatoes sold in retail stores.

In the first week that this operated, nearly 80 per cent of all the samples inspected were below Canada No. 1 grade, and most of those did not even meet the minimum of Grade 2. The policy was adopted of sending any improperly graded lots back to the supplier to be corrected. It took just six weeks to change the picture entirely. By that time 94 per cent of the samples examined in retail stores met the requirements of Canada No. 1 grade. Incidentally, that retail work is being continued in Winnipeg by our staffs acting as inspectors under Manitoba provincial regulations.

That brings you up to date on our inquiries regarding how accurately potatoes are being graded now for sale to consumers. It indicated to us that consumers were not getting potatoes so well graded as they should be and that at least one way of improving that condition was to carry on a more thorough checking of grading right in the retail stores.

I can turn now to the second main issue — whether the present grades are really giving consumers and other users the guide to the quality which they really desire.

The present grade standards take into account external factors such as size, uniformity, freedom from disease and mechanical injury. But desirable as those factors are, the ultimate consumer will not buy potatoes with complete confidence until he is able to walk into any store at any time and buy potatoes which, when cooked, will be of uniformly good eating quality.

The work of which I will next give you the details was undertaken to find out how acceptable, from a cooking standpoint, were potatoes presently being offered on the market and to find out if there was any feasible means of incorporating cooking quality as a factor in potato grading.

The committee working on this used 180 of the retail packages which we picked up early in the year for the grading checks. Potatoes from each sample were baked, boiled and pressure cooked and scored for final acceptability on a combination of color, texture and flavor by

a panel of nine judges. All the samples were also tested for dry matter content by the hydrometer method.

When the combined ratings of the judges were compiled, it was found that nearly one-half of all the samples were lacking sufficiently in one or more factors to be rated as unacceptable.

The results also indicated that there was an apparent close relation between the placings of the taste panel and dry matter content.

The committee used the classifications commonly employed by potato breeders — 18 to 21 per cent dry matter they classified as "good," 15 to 18 per cent as "fair" and under 15 per cent as "poor." On that basis only 25 per cent of all the samples were good and 15 were poor.

Green Mountain showed the highest dry matter content, with an average of 18.3 per cent; and Katahdins the lowest, with an average of 17.1 per cent. Sebagos and Ontario varieties were in between.

On an area basis, those from Quebec were the highest with 18.7 per cent and New Brunswick the lowest with 17.2 per cent. The Ontario potatoes showed an average of 17.7 per cent dry matter content, and P.E.I. 17.8.

However, the tests confirmed what is well known in the potato field — that there is a wide range of dry matter content within the same variety depending on area and cultural methods and that neither variety nor area of production is in itself indication of quality.

Now, obviously, there are many angles to this. For household use, a mealy potato with a high dry matter content may be preferred, particularly for baking. Restaurants may be willing to take a moister potato which will peel well and stay whole when served. The Chip people prefer dryness, but that will be less important to those who make french frieds.

Regardless of those differences it is hoped that from the work which has been conducted to date and from further work which will be done, a feasible means will be found of associating cooking quality with grade standards.

Now, assuming that you and others in the industry agree with the general deductions which we have made from them, where do we go, collectively, to do something about them.

The committee which has been working on this suggested that grading equipment which would separate potatoes according to specific gravity should be built and tried on an experimental basis. In this, advantage has been taken of the very considerable work which has been conducted on the same line in the United States. The preparation of this material is now under way and it is expected that it will be available for experimental trials during the coming season.

There remains the administrative matter of applying potato grading more effectively at the retail level, regardless of what the grade factors may be. Matters of staffs and appropriations and relative provincial and federal jurisdictions are involved in this. At this stage I can only tell you that we are hopeful, within the Marketing Service, of developing a retail inspection staff to apply grading regulations at that level on all commodities with which we are authorized to deal. As that materializes we should be in an increasingly good position to be able to see to it that when consumers buy potatoes marked with a grade name they will actually get potatoes of the grade they are buying.

COMPARISON OF CERTAIN STANDARD AND EXPERIMENTAL FUNGICIDES IN POTATO LATE BLIGHT CONTROL[1, 2]

J. H. Muncie[3]

Nearly every year new materials are offered by the manufacturing companies as possible fungicides in potato late blight control. Potato growers are very much interested in the relative effectiveness of the various new potato fungicides, but look to the state experiment stations to make critical tests before adopting the new materials into their spray programs.

In Michigan, it is often difficult to predict the areas in the state where weather conditions will be favorable for the development of late blight epidemics in any particular year. During the season of 1951, however, ideal conditions not only for potato late blight but also for testing fungicides for the control of this disease were obtained at the Experiment Station, Lake City, Michigan.

Materials and Methods

Field tests were conducted at the Lake City Experiment Station in which 14 materials were compared regarding their effectiveness in potato late blight control. The experimental organic fungicides were as follows: number 1217 (in slurry form) from Carbide and Carbon Chemical Co.; numbers 1124 and 1189 and fungicide C, a combination of number 1189 with a fixed copper, General Chemical Co.; Orthocide 406, California Spray Chemical Co.; manganese ethylene bisdithiocarbamate, E. I. du Pont de Nemours Co.; materials numbers F1003 and F1009, The Dow Chemical Co. The experimental inorganic material was Cop-O-Zinc, furnished by Tennessee Corporation. The standard fungicides consisted of Bordeaux mixture, Tribasic copper sulfate, Parzate (powder) and Dithane D-14, to which zinc sulfate was added. DDT was added to the fungicide at each application and all the plots were sprayed once during the season for aphid control.

The spray plots consisted of 4 rows randomized for materials and replicated four times. Plots were laid out so that a check plot sprayed only with DDT (2 pounds 50 per cent wettable — 100 gallons) adjoined each plot sprayed with a fungicide. The plots, 100 feet long, were planted to the variety Chippewa May 15 and harvested on September 11. Spray applications were made on the following dates: June 29, July 9, 18, 24, August 1, 8, 14, 21 and 28 with a four row, engine-driven, tractor-drawn sprayer. Water, when needed, was applied by overhead rotating sprinklers at the rate of 1½ acre inches per application.

[1]Accepted for publication March 4, 1952.
[2]Contribution 52—6, Department of Botany and Plant Pathology, Michigan State College, East Lansing, Mich. and Journal Article Number 1386 of the Michigan Agricultural Experiment Station.
[3]Professor of Botany and Plant Pathology, Michigan State College, East Lansing, Mich.
The writer is indebted to Mr. A. M. Berridge, Superintendent of the Lake City Experiment Station for assistance in these tests; also the county agricultural agents and potato growers for aid in the county spray and dust materials trials, and to the cooperating manufacturers of agricultural chemicals for these materials and for other assistance furnished.

Weather conditions during the season were generally favorable for late blight infection. During June precipitation occurred on 10 days to the amount of 1.89 inches. In July 4.37 inches of rain fell on a total of 14 days with high precipitation on July 2, 3, 4 and 5 (2.09 inches). During August, precipitation was 1.99 inches for 13 days. As a result of rains and irrigation at frequent intervals, the vines were kept moist for several consecutive hours. Temperatures were also favorable for late blight infection. The average maximum and minimum temperatures were as follows: June, 75.2°F. and 47.9°F.; July, 79.0°F. and 53.9°F.; August 76.0°F. and 51.4°F. There were 20 days in June during which the minimum temperature was 50°F. or less; in July, 8; and in August, 14 days.

Late blight in trace amounts was found on July 16 at the ends of four check plots at the west end of the field. Infection, apparently had spread from the main field, separated from the spray plots by a 20-foot roadway. Late blight had been present in the main field for approximately two weeks before it was discovered in the spray plot checks. Abundant moisture and favorable temperatures in July and August were favorable for further spread of the late blight fungus and on August 15 there were some infected plants in all the plots sprayed with fungicides. On August 22, most of the plants in the check plots were dead. With a heavily blighted check plot adjoining each sprayed plot, very severe conditions were maintained for testing the efficiency of the fungicides in late blight control. Foliar infection readings were made on August 15. The plots were harvested September 11 at which time the second row of each was harvested and the potatoes were then graded and carefully sorted for blight infected tubers. Data on yields and percentage of foliage and tuber infection are given in table 1.

Results of Spraying

Yields. Results of these field trials show that for total yield the increases from applications of materials number 1189, Parzate, Orthocide 406, manganese ethylene bisdithiocarbamate, F1003, Fungicide C and Cop-O-Zinc were statistically significant over check plots sprayed only with DDT.

All the fungicides used except F1109 and number 1217 slurry at 5 pounds in 100 gave yields of U. S. number 1 grade significantly better than check, and the latter material lacked only a fraction of a pound in significant yield difference. Under conditions of this experiment, the following experimental materials gave outstanding yields of U. S. number 1 grade potatoes: F1003, manganese ethylene bisdithiocarbamate, Orthocide 406, Cop-O-Zinc and Parzate.

Late Blight Control. Although late blight infection was found in all the spray materials plots, its spread was relatively slow until approximately August 15. This, coupled with the fact that the Chippewa variety was planted early, allowed almost normal set of tubers before serious defoliation occurred. Thus there was little or no correlation between defoliation and yield. As compared with the check plots (DDT only) which showed almost complete killing by late blight at this time, the spray materials in general, greatly reduced foliage infection.

TABLE 1.—*Results of tests of spray material on potatoes. Lake City, Michigan Experiment Station 1951.*

Materials and Dosage	Yield in Bushels per Acre			Late Blight Infected Leaves August 15th Per cent	Late Blight Tuber-rot Per cent
	Total	U. S. No. 1	U. S. No. 2		
1. 1189 G. C. 4 — 100	336.5*	298.4*	27.5	20.0	0.6
2. Dithane D-14 2 qts. — ¾ lb. Zn — 100	309.4	294.1*	24.4	19.0	4.9
.3 Parzate (dry) 2 — 100	344.1*	307.2*	25.0	21.5	4.8
4. F 1109 4 — 100	254.2	225.8	21.2	8.2	3.9
5. Tribasic 4 — 100	292.0	266.4*	21.1	51.2	2.5
6. 1217 Slurry 5 — 100	288.3	260.6	25.2	32.5	3.9
7. Orthocide 406 2 — 100	354.7*	323.5*	28.6	50.7	1.9
8. Bordeaux 8 — 4 — 100	309.2	280.7*	23.3	28.2	1.2
9. Mn. Ethylene Bis. 2 — 100	363.1*	330.7*	29.2	10.2	0.4
10. F 1003 2 qts.—¾ lb. Zn — 100	373.0*	344.8*	24.8	71.2	1.3
11. Fungicide "C" 4 — 100	336.1*	297.5*	24.9	77.5	2.1
12. 1124 G. C. 4 — 100	315.8	284.2*	27.2	14.0	1.5
13. Cop-O-Zinc 4 — 100	349.9*	315.8*	24.7	12.8	2.8
14. 1217 Slurry 6¾ — 100	293.9	266.6*	22.6	14.0	4.9
15. Check (DDT) 2 — 100	257.2	209.9	25.2	91.2	2.8
L.S.D. — 5 per cent level	67.6	51.3	N. S.		

Data recorded on the percentage of tubers with late blight also indicate that certain spray materials were effective in the prevention of tuber rot. Plots sprayed with manganese ethylene bisdithiocarbamate and materials numbers 1189, 1124, F1003, Orthocide 406 and Bordeaux mixture showed much less tuber rot than check plots or those sprayed with other fungicides. It may be that the above materials were much more effective as "ground sprays" in preventing the fungus from infecting the tubers. Certain materials, such as F1003, Tribasic, Orthocide 406 and Fungicide C showed a low percentage of tuber rot but relatively high foliage infection, whereas with Parzate, number 1217 slurry and Dithane, the reverse is indicated. The use of the early-maturing variety Chippewa and the uneven spread of infection in the checks and sprayed plots probably account for some of the differences in foliage infection. Under conditions of frequent precipitation as rain or dew and with overhead irrigation, relative adhesiveness of the fungicides may also be an important factor in late blight defoliation. The low incidence of tuber rot and low yield in the check plots resulted from early and rapid killing of the vines after the tubers were set.

County Spray and Dust Trials

Field trials of spray materials were also conducted in potato growers' fields in Houghton, Kalkaska and Menominee Counties. One trial with dust formulations was made in Eaton County on muck-grown potatoes.

The materials tested consisted of Tribasic copper sulfate (from two sources) Cop-O-Zinc (two formulations), Orthocide 406, Parzate, General Chemical number 1189 (dust) Dithane D-14 plus zinc sulfate and Bordeaux mixture. All tests included Tri-basic copper sulfate, Cop-O-Zinc and Orthocide 406, with certain other materials added to the tests as local conditions warranted. Plots for each material were approximately one acre in size.

With the exception of the plots in Menominee County, late blight was either absent or appeared so late in the season that infection was negligible. In Menominee County, late blight appeared in July and progressed rapidly under favorable moisture and temperature conditions. Although 6 or 8 applications of fungicide were made on all other plots, those in Menominee County received 13. In these plots, late blight first appeared in a low area in the plot sprayed with Tri-basic copper sulfate (plot 2) and spread laterally to those receiving Dithane D-14 (plot 1), Cop-O-Zinc (plot 3), Orthocide 406 (plot 4) and Bordeaux mixture (plot 5). The latter plot was separated from the others of the series by several rows of corn which no doubt accounted for somewhat lighter late blight infection. In Houghton and Kalkaska Counties, sufficient dry weather prevented infection in the plots.

The results of these trials are given in table 2 and show higher average yields in the three counties from applications of Cop-O-Zinc and Orthocide 406 than from Tribasic copper sulfate.

In Menominee County, plots sprayed with Dithane D-14 plus zinc sulfate gave outstanding yields and in Houghton County, the Calumet and Hecla formulated Tribasic copper sulfate gave the highest yield. In the Kalkaska County plots, those sprayed with Parzate (dry form) showed

TABLE 2.—*County spray plots 1951.*

Materials and Dosage	Kalkaska County (1) Bus. per Acre			Menominee County (2) Bus. per Acre			Houghton County (3) Bus. per Acre			Average Bus. per Acre		
	Total	U.S.No.1	U.S.No.2	Total	U.S.No.1	U.S.No.2	Total	U.S.No.1	U.S.No.2	Total	U.S.No.1	U.S.No.2
Bordeaux 8-4-100				374.0	355.7	18.3						
Tenn. Corp. Tribasic 4-100	250.4	225.4	25.0	282.4	266.9	15.5	396.0	356.4	39.6	309.6	282.9	26.7
Cop-O-Zinc 4-100	296.9	267.2	29.7	408.9	396.1	12.8	388.0	349.2	38.8	364.6	337.5	27.1
Orthocide 406 2-100	283.5	255.2	28.3	400.5	380.3	20.2	358.5	322.6	35.8	347.5	319.4	28.1
Parzate 2-100	256.4	230.8	25.6									
Dithane D-14 2 qts.—¾ lb. Zn-100				506.1	486.9	19.2						
Tenn. Corp. 49-4							356.5	320.8	35.7			
Cal. & Hecla Tribasic							432.8	389.5	43.3			

(1) Rex McCool Farm, Katahdin variety — 6 applications
(2) Ed. Kline Farm, Russet Rural variety — 13 applications
(3) Fritz Dittama Farm, Sebago variety — 8 applications

much less early blight infection although yields were not so good as those sprayed with Orthocide 406 or Cop-O-Zinc.

One series of dust plots was conducted in Eaton County. These were planted to the Katahdin variety and grown on muck soil without irrigation. Because of unfavorable weather conditions late blight was absent. The materials used were Tribasic copper sulfate and Cop-O-Zinc as 7 per cent metallic copper in the dust formulation and Orthocide 406 and General Chemical Co. number 1189 in 10 per cent formulation. Six applications at 50 pounds per acre were made during the season. All dust applications were made early in the morning to take advantage of dew on the plants, and the quiet atmosphere.

Results of these tests are given in table 3 and show slight increases in yields from plots dusted with Orthocide 406 and General Chemical number 1189 as compared with Tribasic copper sulfate and Cop-O-Zinc. Yield differences, however, were not statistically significant.

TABLE 3.—*Eaton County dust plots*[1, 2]

Yield in bushels per acre

Materials.	Total	U .S. No. 1	U. S. No. 2
Tribasic	333.0	315.0	18.0
Cop-O-Zinc	324.0	310.5	13.5
Orthocide 406	351.0	342.0	9.0
Gen. Chem. 1189	369.0	358.2	10.8

1. Thomas Clark, grower. Katahdin variety.
2. 6 applications, 50 pounds per acre.

THE RELATIONSHIP OF THE SPECIFIC GRAVITY OF SIX VARIETIES OF POTATOES TO THEIR MEALINESS AS ASSESSED BY SENSORY METHODS[1]

Mary L. Greenwood[2, 3], Margaret Harvey McKendrick[2, 3] and Arthur Hawkins[3]

That the specific gravity of potatoes is closely related to their mealiness is a well-known fact. However, the discrepancy in this relationship would seem to warrant further investigation. Potato tubers with similar specific gravities may not always exhibit the same degree of mealiness. Furthermore, in the development of new varieties, the specific gravity may not be a reliable indication of the true mealiness.

The investigation reported here was undertaken (1) to provide additional information regarding the relationship between specific gravity of potatoes and their mealiness as assessed by sensory methods and (2) to determine the relative mealiness of certain new varieties of potatoes grown in Connecticut.

Procedure

The potatoes used in the experiment were grown in field trials conducted in cooperation with commercial growers by the Agronomy Section of the Plant Science Department at the University of Connecticut. Eight varieties were planted in 8 x 8 latin squares on each of two farms — one irrigated and one not irrigated. Eight replicate samples of each variety were thus available from each farm for specific gravity tests made by the water displacement method in December and again in March 1950. Each sample consisted of eight to ten tubers.

To simplify the tests to determine the degrees of mealiness of the potatoes, only six of the eight varieties were used. The varieties chosen were Green Mountain, Katahdin, Kennebec, Mohawk, Ontario, and Chippewa, the first and last named representing extremes in specific gravity.

Four potatoes from each of the samples were used for the mealiness tests. Each raw potato was first cut into quarters and then as nearly as possible into one-half inch cubes, taking care to leave the skin intact. The whole potato was then re-formed by fitting the quarters together again, and holding them in place by wrapping them with aluminum foil which had been punctured with a fork to allow steam to escape. The potatoes were baked at 425°F. until tender. The foil was then removed, and the individual samples assembled by taking one quarter of each of the four potatoes. Each judge tasted a cube from a quarter of each of the four potatoes, in as nearly the same relative part of the tuber as possible, before forming his judgment regarding the mealiness of the sample.

This method of preparation allowed sampling from more than one tuber without changing the original texture of the baked potato. Preliminary work (6) indicated that this method of preparation was satisfactory for assessing the mealiness of cooked potatoes.

[1]Accepted for publication March 5, 1952.

[2]School of Home Economics.
[3]Department of Plant Science, Storrs Agricultural Experiment Station, University of Connecticut, Storrs, Conn.

In each taste test, six samples were presented, consisting of one sample from each of the six varieties grown in a single row of the latin square. Since each of the six varieties appeared eight times in the latin square, eight such tests were conducted on potatoes from each of the two farms, making 16 tests in all. Four tasters of the 12, scored the composite samples (four tubers for each sample) in each test on an absolute scale of 10, the data for which are presented herewith. A score of one indicated a very watery potato and a score of 10 a very mealy one. The remaining eight tasters, by a system of rotation, scored the samples by ranking and by checking descriptive terms. The three methods checked one another closely and for reasons of simplification the results of only one method are given here. A comparison of the scoring methods is presented in another article by Greenwood, McKenrick, and Bliss (2).

Students and staff members in the School of Home Economics at the University of Connecticut acted as tasters. The same 12 tasters served throughout the 16 tests which comprised the experiment.

Results and Discussion

The six varieties of potatoes differed significantly from one another both in specific gravity and mealiness scores on each of the two farms. In table 1 the varieties are arranged in descending order of specific gravity. On Farm H (irrigated) they range from a high of 1.0729 for Green Mountain to a low of 1.0563 for Chippewa. Green Mountain and Mohawk, and Ontario and Katahdin differ significantly from one another if compared on the basis of the "least significant difference" for adjacent means. Differences between other adjacent means are not significant. On Farm M (unirrigated) the order of the varieties is changed somewhat with Mohawk receiving a higher rating than Green Mountain. However, the only significant differences in adjacent varieties are those between the three lowest, Kennebec, Katahdin, and Chippewa. The average specific gravity for Farm M is slightly higher than for Farm H.

It can be seen from observation of table 1 that on Farm H the mealiness scores follow closely the specific gravity ratings, with Ontario seemingly out of line. In fact, the differences in the mealiness scores for the varieties can be accounted for wholly by the differences in their specific gravities, as indicated by an analysis of covariance. On Farm M, however, the mealiness scores for the varieties seem to show little correlation with the specific gravity ratings even though they differ significantly from one another. The mealiness score for Green Mountain is significantly higher than that for Mohawk though its specific gravity rating is lower. Likewise, Kennebec and Katahdin scored significantly higher than Mohawk. Chippewa, with the lowest specific gravity rating, still received the lowest mealiness score. After accounting for the differences in specific gravity the mealiness scores still differ significantly from one another as indicated by an analysis of covariance.

Neither the specific gravity ratings nor the mealiness scores for the replicates differ significantly from one another on either of the farms as shown by an analysis of variance. The relatively small differences in mealiness scores between replicates within a variety showed no significant relationship to the small differences in specific gravity.

TABLE 1.—*Specific gravity and mealiness scores of six varieties of potatoes for each of two farms — Connecticut, 1950*

Farm H (Irrigated)

Variety	Specific Gravity[1]	Mealiness Score[2]
Green Mountain	1.0729	5.8
Mohawk	1.0645	5.2
Kennebec	1.0638	4.7
Ontario	1.0625	3.9
Katahdin	1.0580	4.4
Chippewa	1.0563	3.8
Mean	1.0630	4.6
Least significant difference (.05)		
Adjacent means	0.0032	0.4[3]
Any two means	0.0069	1.0

Farm M (Unirrigated)

Variety	Specific Gravity[1]	Mealiness Score[2]
Mohawk	1.0711	4.2
Green Mountain	1.0697	6.9
Ontario	1.0678	4.2
Kennebec	1.0648	5.0
Katahdin	1.0610	5.0
Chippewa	1.0565	3.4
Mean	1.0652	4.8
Least significant difference (.05)		
Adjacent means	0.0036	0.5[3]
Any two means	0.0076	1.0

[1]Mean value of eight replicates, each replicate containing eight to ten tubers; determined by water displacement method.
[2]Mean value of eight replicates for four judges tasting four tubers from each replicate.
[3]Applicable only when mealiness scores are rearranged in order of magnitude.

It is of interest to note that the season (1949) in which these potatoes were grown was the hottest and driest on record until the last of August. The temperature was cooler and rainfall ample in September. It was necessary to resort to irrigation on Farm H but no such facilities were available on Farm M. However, the soil on Farm M had a higher moisture holding capacity than that on Farm H. Most varieties were green until September 20 on Farm M and until October 1 on Farm H.

It is an unfortunate circumstance that the untoward weather conditions produced an exceptionally high variability in the specific gravity within varieties of the potatoes. The coefficients of variation for this factor for Farm H and Farm M were 25.8 per cent and 22.1 per cent, respectively. In the 1950 crop year the coefficients of variation in the specific gravity of the potatoes from these same two farms were only 14.4 and 9.4 per cent respectively (3). Still other farms in the 1948 crop year showed coefficients of variation of 7.0 and 9.3 per cent for the same six varieties (3).

The average specific gravities for the six varieties in the 1949 crop year were lower than in either the preceding or following years (3). The unfavorable weather conditions during the growing season were probably the cause for the low specific gravities (7). The relatively low scores for mealiness indicate that the tasters did not consider the potatoes to be very mealy. The highest mean score assigned to a variety was 6.9 out of a possible score of 10.

Other investigators have found some discrepancy in the relationship between specific gravity and mealiness of potatoes. Kirkpatrick and others (4) working with four varieties of early-crop potatoes, ranging in specific gravity from 1.06 to 1.08, found no significant correlation between specific gravity and mealiness in boiled, mashed, or baked potatoes. Logically, one might have expected such correlations to exist since a significant correlation existed between the specific gravity and dry matter, and between mealiness and dryness as determined by taste tests in boiled and mashed potatoes.

The specific gravity did not indicate correctly the starch contents, nor by inference the mealiness, of potatoes stored either at very high (75°F.) or very low (35°F.) temperatures in an investigation conducted by Whittenberger (8). The underestimation of starch at the high temperature can likely be explained by the increased proportion of skin caused by shrinkage of the tuber. The overestimation at the low temperature is due to the change of starch to sugar.

In evaluating the mealiness of new varieties of potatoes it would seem that sensory methods should be employed as well as specific gravity ratings until a more satisfactory objective method can be found. The Mohawk variety ranked high in the present study in specific gravity but the mealiness score was relatively low on Farm M. Ontario ranked low in mealiness in relation to its specific gravity on both farms. Campbell (1) likewise found that Mohawk ranked lower in mealiness than would be indicated by its specific gravity. In reference to the varieties it should be noted that Ontario also darkened after cooking which fact would rule it out as a satisfactory potato for culinary purposes.

Choice of variety is apparently an important factor in determining the quality of potatoes which arrive at the markets. Merchant and others (5) have pointed out that different varieties vary in their susceptibility to grade defects, both external and internal, such as cuts and bruises and net necrosis. It is equally clear that varieties vary in mealiness, which is an important factor so far as "cooking" or "eating" quality is concerned. The goal of the potato breeder will be reached when a potato variety is produced which is of consistently good eating quality and resistant to bruising as well as being high yielding and disease-resistant. Until that time arrives it would seem that mealiness as a factor in eating quality should receive consideration in the choice of varieties for commercial production. Specific gravity cannot be used entirely as a means of assessing the mealiness of potatoes.

Summary and Conclusions

The relationship between the specific gravity and mealiness as assessed

by sensory methods of six varieties of potatoes grown on each of two farms was determined.

A close relationship between specific gravity and mealiness existed in the potatoes grown on one of the farms. Significant differences in mealiness scores could be accounted for wholly on the basis of differences in specific gravity.

On the second farm the mealiness scores bore little relationship to the specific gravity ratings though they differed significantly from one another.

Of the six varieties tested, Green Mountain ranked high in mealiness and Chippewa low. The remaining varieties — Katahdin, Kennebec, Mohawk, and Ontario — were intermediate in value. With respect to the relationship of mealiness to specific gravity, the Mohawk was out of line at one location and the Ontario variety at both locations.

Specific gravity apparently may not be used safely as the sole criterion in assessing the mealiness of potatoes.

Acknowledgment

The authors acknowledge the aid of C. I. Bliss, Biometrician, Connecticut Agricultural Experiment Station; Marian E. Owen; and all the tasters who acted as subjects throughout the experiment.

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FIELD CROP INSECTS. F. A. FELTON. (319 pp., 224 illustrations. Macmillan Co., publishers, New York, 1952.)

This book is primarily concerned with the insect pests that are of importance in the production of food, fiber and forage crops in the mid-western section of the United States. The first one-third of the book contains an excellent discussion of the basic principles of insect biology and the various methods of insect control. The chemical control of insects is covered in three chapters which discuss insecticides and their application, as well as crop sprayers and dusters for insecticides.

The author bases insect classification on feeding habits and devotes one chapter to each of the major field crop pests, as follows: leaf and plant destroying insects; sap-sucking; fruit feeding; soil-inhabiting; borers and other internal-feeding insects; feeders on floral parts and seeds; and feeders on broken seeds and farinaceous materials. Felton also gives a brief description of each insect, as well as the life history, habits and control measures.

This book is well illustrated and has ample references to the subject matter, and should prove to be a very useful book to all students and investigators who specialize in the study of field crop insects.

This book probably would not be of particular interest to the potato grower because of its emphasis on field crop insects, only a few of the potato insects are thoroughly discussed.

Robert Filmer, Entomologist
Rutgers University
New Brunswick, N. J.

PROGRAM OF THE ANNUAL MEETING OF THE POTATO ASSOCIATION OF AMERICA

September 8, 9, 10, 1952
Ithaca, New York

Monday Morning, September, 8, 1952, Room 207, Baker Laboratory, 9:30 A. M.
Joint Session with Vegetable Crops Section of American Society for Horticultural Science.

H. O. Werner, *Chairman*

1. *Yield tests of potato seedlings in greenhouses.* (12 min.) F. A. KRANTZ, University of Minnesota, St. Paul, Minn.
2. *Sampling potatoes for phosphorus analysis.* (14 min.) W. C. JACOB, Cornell University, Ithaca, N. Y.
3. *Response of Kennebec potatoes to maleic hydrazide treatment.* (Illustrated, 2 x 2 and 3¼ x 4) (10 min.) E. L. DENISON, Iowa State College, Ames, Iowa.
4. *Sprouting response of seven potato varieties in storage as affected by foliage application of maleic hydrazide.* (Illustrated 2 x 2) (15. min.)E. J. KENNEDY and ORA SMITH, Cornell University, Ithaca, N. Y.
5. *Some morphological studies of maleic hydrazide induced dormancy in onions and potatoes.* (Illustrated 2 x 2) (10 min.) S. N. RAO and S. H. WITTWER, Michigan State College, East Lansing, Mich.
6. *Potato emergence as influenced by seed treatment and preharvest vine application of maleic hydrazide.* (Illustrated 2 x 2) (12 min.) E. J. KENNEDY and ORA SMITH, Cornell University, Ithaca, N. Y.
7. *Potassium fertilization effect on some soluble nitrogen constituents of the potato tuber in relation to the black spot problem.* (Illustrated 2 x 2) (15 min.) C. H. VAN MIDDELEM, University of Florida, Gainesville, Florida, W. C. JACOB and H. C. THOMPSON, Cornell University, Ithaca, N. Y.
8. *Relative turgidity of potato leaves as influenced by environment and variety.* (Illustrated 2 x 2) (12 min.) H. O. WERNER and JOAN M. WALLACE, University of Nebraska, Lincoln, Nebr.
9. *Study of specific gravity and storage temperatures as related to chip manufacture in early summer white potatoes.* (12 min.) F. D. COCHRAN, C. L. McCOMBS and J. C. TAYLOR, North Carolina State College, Raleigh, N. C.
10. *The mechanism for the development of color in potato chips.* (15 min.) ROBERT SHALLENBERGER and ORA SMITH, Cornell University, Ithaca, N. Y.

Monday Afternoon, September 8, Room 131, Roberts Hall, 1:30 P. M.

J. H. Muncie, *Chairman*

1. *Artificial treatment of potato chip slices as it affects the quality of the chips.* (15 min.) D. K. SALUNKHE, E. J. WHEELER and S. T. DEXTER, Michigan State College, East Lansing, Mich.
2. *Specific gravity and date of planting as it influences the color of potato chips.* (15 min.) E. J. WHEELER and D. K. SALUNKHE, Michigan State College, East Lansing, Mich.
3. *Factors affecting quality of french fries.* (15 min.) P. H. HEINZE and MARY E. KIRKPATRICK, U. S. D. A., Beltsville, Md.
4. *Constituents other than reducing sugars that cause color in potato chips.* (15 min.) R. S. SHALLENBERGER and ORA SMITH, Cornell Un versity, Ithaca, N. Y.
5. *A review of the nitrogenous constituents of the potato; nutritive value of the essential amino acids.* (20 min.) E. A. TALLEY and C. F. WOODWARD, Eastern Regional Research Laboratory, Philadelphia, Pa.

6. *Chemical reactions which cause color of potato chips.* (15 min.) R. S. SHALLANBERGER and ORA SMITH, Cornell University, Ithaca, N. Y.
7. *Effect of field applications of maleic hydrazide on quality of potatoes and of potato chips.* (15 min.) E. J. KENNEDY and ORA SMITH, Cornell University, Ithaca, N. Y.
8. *Preparation of potato granules by solvent dehydration.* (20 min.) E. G. HEISLER, ANN S. HUNTER, C. F. WOODWARD and R. H. TREADWAY, Eastern Regional Research Laboratory, Philadelphia, Pa.

Monday Afternoon, 4:30 P. M.
Tea at the Ora Smith home, Slaterville Road.
This is on the way to the Bethel Grove Community Hall.

Monday Evening, Dinner – 6:30 P. M.
Bethel Grove Community Hall, Slaterville Road.

Toastmaster — Arthur Hawkins

Presidential Address — Dr. G. H. Rieman

Announcement of 1952 Honorary Life Members

Presentation of Honorary Life Members

Address — Kris Bemis, *Secretary*
Potato Division
United Fresh Fruit & Vegetable Association
Washington, D. C.

Tuesday Morning, September 9, Room 131, Roberts Hall, 9:00 A. M.

G. H. RIEMAN, *Chairman*

Business Meeting
- Report of Secretary
- Report of Treasurer
- Report of Editor of American Potato Journal
- Report of Certification Committee
- Report of Potato Introduction Committee
- Report of Membership Committee
- Report of Resolutions Committee
- Report of Auditing Committee
- New Business
- Report of Nominating Committee
- Election of Officers

Tuesday Afternoon, September 9, Room 233, Plant Science Bldg., 1:30 P. M.
Joint Session with American Phytopathological Society.

G. H. RIEMAN, *Chairman*

1. *Meteorological data correlated with potato and tomato late blight in Northeastern United States.* R. A. HYRE, U. S. Department of Agriculture and University of Delaware, Newark, Del.
2. *Forecasting late blight in Indiana from mean temperature and cumulative rainfall data.* (Illustrated) (15min.) J. R. WALLIN and R. W. SAMSON, U. S. Department of Agriculture, Ames, Iowa, and Purdue Agricultural Experiment Station, Lafayette, Ind.
3. *Field studies on the development and survival of "Phytophthora infestans" sporangia on potato and tomato plants.* (Illustrated) (15 min.) J. R. WALLIN, U. S. Department of Agriculture, Ames, Iowa.
4. *The appearance and survival of new races of "Phytophthora infestans."* (Illustrated 2 x 2) (15 min.) H. D. THURSTON and CARL J. EIDE, Minnesota Agricultural Experiment Station, St. Paul, Minn.

5. *Evaluation of the phloroglucinol test for diagnosis of potato leafroll.* (Illustrated 2 x 2) (10 min.) JOHN J. NATTI, New York State Agricultural Experiment Station, Geneva, N. Y.
6. *Yearly D-D treatments and continuous potato production in relation to the golden nematode population of the soil.* (Illustrated 2 x 2) (15 min.) W. F. MAI and BERT LEAR, Cornell University, Ithaca, N. Y.
7. *Natural barriers protect potatoes from soft rot infection.* (Illustrated 2 x 2 and 3¼ x 4) (15 min.) WILSON L. SMITH, JR. and HELEN F. SMART, U. S. Department of Agriculture, Beltsville, Md.

Wednesday Morning, September 10, Room 131, Roberts Hall, 9:00 A. M.

A. E. MERCKER, *Chairman*

1. *Rapid test for the production of color in the cooked potato.* (15 min.) N. R. THOMPSON, Dominion Dept. of Agriculture, Ottawa, Canada, and E. J. WHEELER, Michigan State College, East Lansing, Mich.
2. *Some factors influencing specific gravity of potato varieties in Pennsylvania. Three years' results.* (15 min.) J. S. COBB, Pennsylvania State College, State College, Pa.
3. *Specific gravity of varieties and seedling families of potatoes.* (10 min.) ORRIN C. TURNQUIST, University of Minnesota, St. Paul, Minn.
4. *Time and waste of peeling as influenced by variety and tuber size.* (10 min.) H. O. WERNER, University of Nebraska, Lincoln, Nebr.
5. *Marketing of specific gravity graded potatoes.* (30 min.) M. P. RASMUSSEN, Cornell University, Ithaca, N. Y.
6. *Interpretations of consumer acceptance tests.* (20 min.) F. A. KRANTZ, University of Minnesota, St. Paul, Minn.
7. *Effect of grading, harvesting, transportation and handling on quality.* (20 min.) J. M. LUTZ and HERBERT FINDLEN, U. S. D. A., East Grand Forks, Minn.
8. *Our markets, our research and our sales of potatoes.* (30 min.) KRIS P. BEMIS, United Fresh Fruit & Vegetable Assoc., Wash., D. C.
9. *Cooking quality of potatoes — its evaluation and relationship to potato characteristics* (30 min.) MARY KIRKPATRICK, U. S. D. A., Beltsville, Md.

Wednesday Afternoon, September 10, Room 131, Roberts Hall, 1:30 P. M.

N. M. PARKS, *Chairman*

1. *Embryo culture in "Solanum tuberosum."* (15 min.) FRANK L. HAYNES, North Carolina State College, Raleigh, N. C.
2. *A preliminary statistical genetic investigation in Irish potatoes.* (15 min.) CHARLES E. GATES, North Carolina State College, Raleigh, N. C.
3. *Differences in rates of wound healing by tubers of different clones of varieties as determined empirically.* (15 min. lantern) H. O. WERNER, University of Nebraska, Lincoln, Nebr.
4. *Periderm development of the potato tuber in relation to scab resistance.* (15 min.) D. C. COOPER, G. H. RIEMAN and G. W. STOKES, University of Wisconsin, Madison, Wis.
5. *Carbon dioxide passage through natural and wound periderm of potatoes.* (10 min.) R. L. SAWYER and ORA SMITH, Cornell University, Ithaca, N. Y.
6. *Advance cutting versus disinfection for preservation of cut seed pieces.* (15 min. lantern.) H. O. WERNER, University of Nebraska, Lincoln, Nebr.
7. *Tuber and seed piece sizes as factors in western Nebraska dryland potato production.* (10 min. lantern.) H. O. WERNER, University of Nebraska, Lincoln, Nebr.
8. *Varietal susceptibility to internal brown spot of potatoes.* (15 min.) J. HOWARD ELLISON, Long Island Vegetable Research Farm, Riverhead, N. Y.
9. *Effect of sprout inhibitors on the incidence of Fusarium dry rot and sprouting of potato tubers.* (15 min.) J. HOWARD ELLISON and H. W. CUNNINGHAM, Long Island Vegetable Research Farm, Riverhead, N. Y.


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